UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/725,061	12/02/2003	Kazushi Sato	245990US6	2933

22850 7590 04/10/2009
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
GE, YUZHEN	

ART UNIT	PAPER NUMBER
2624	

NOTIFICATION DATE	DELIVERY MODE
04/10/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
jgardner@oblon.com

Office Action Summary	**Application No.** 10/725,061	**Applicant(s)** SATO ET AL.	
	Examiner YUZHEN GE	**Art Unit** 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 04 March 2009.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-11 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-11 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Examiner's Remark

Applicant's amendment, filed on 3/4/2009, has been received and entered into the file. The 112 second paragraph rejections of claims 1-11 have been overcome in view of applicant's amendments/remarks and are hereby withdrawn.

Regarding applicant's argument that Butter does not explicitly describe that the refinement search within the non-downsampled match is performed "within a search range including a plurality of peripheral pixels in a rectangular range having apexes of start and end points of a motion vector detected in a lower layer", the examiner would like to point out that although Butter does not use the same wording, but the amended limitation is implicitly and inherently taught. As described in col. 8, lines 30-49 of Butter, a search window/rectangle which includes a plurality of peripheral pixels is defined as search range and the best match diff/offset results are passed in a daisy-chain fashion from one unit to another. Therefore the refinement search must performed within a search range including a plurality of peripheral pixels in a rectangular range having apexes of start and end points of a motion vector detected in a lower layer. Furthermore, col. 7, lines 44-54 of Butter also teaches that the new search range includes a plurality of peripheral pixels in a rectangular range having apexes of start and end points of a motion vector detected in a lower layer. The hierarchical search of Butter must be performed this way; otherwise there is no advantage of doing it. Therefore Butter implicitly and inherently teach this added limitation.

Regarding applicant's argument that Karczewicz does not describe increasing a size of motion vector using linear interpolation, the examiner would like to point out that the instant application also does not explicitly explain how to increase a size of motion vector using linear

interpolation. The examiner regards the teaching of Karczewicz as increasing a size of motion vector because when a motion vector has whole pixel resolution, for example, the size/offset can only terminates at pixel locations. However when a motion vector has sub-pixel resolution, the size of the motion vector can be increased to that of the sub-pixel locations. The examiner also considers this limitation the same way in the instant application and therefore no 112 rejection is advanced. Thus Karczewicz teaches increasing a size of a motion vector using linear interpolation.

Arguments on other claims depend on those of claim 1. Therefore the 103 rejections of claims 1-11 have not been overcome.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-6 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Butter et al (US Patent 6,549,575) in view of Karczewicz et al (US Patent 6,950,469).

Regarding claim 1, Butter et al teach a method of compensating motion prediction relative to each of a plurality of motion compensating blocks formed by dividing an objective frame image of successive frame images using a plurality of reference frame images while sequentially changing pixel-based sizes of the plurality of motion compensating blocks (Figs. 5-8, col. 6, lines

3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49), the method comprising steps of:

thinning out pixels (down sampling 203 in Fig. 5) of a motion compensating block having a greatest pixel-based size (original size before down sampling) to be taken as an uppermost layer of among blocks with smaller pixel-based sizes, each different pixel-based size of a block corresponding to a different layer of a frame image (col. 7, lines 18-34, each of the downsampled images corresponding to a layer), to generate a size-reduced block in a lower layer having a predetermined size-reduction ratio (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49);

determining motion vector search ranges (col. 6, lines 59-67, the search range is based on the offset of the best down sampled match, col. 9, lines 9-14) respectively within the plurality of reference frame images, based on a plurality of size-reduced reference images (either I, or P images can be used as reference images, col. 5, lines 17-29, also a B picture have two reference images) reduced in size corresponding to the size-reduction ratio of the sized-reduced block (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49, the search window is considered to be the search range and is determined before the search is performed) by detecting motion vectors respectively within the plurality of sized-reduced reference images (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49) and increasing a size of the motion vectors (Fig. 5, col. 10, lines 11-22, the corresponding motion vector with half resolution search has sized that has been increased compared with down sample full pixel search or full pixel search, col. 10, lines 55-67) to provide motion vector search ranges with respect to the plurality of reference frames images

which correspond to an increased size of the motion vectors (Figs. 5-7, col. 10, lines 11-22 and 55-67), wherein for each layer of a frame image except a lowermost layer, motion vectors are detected within a search range which includes a plurality of peripheral pixels in a rectangular range having apexes corresponding to start and end points of a motion vector detected in a lower layer (col. 8, lines 30-49, a search window/rectangle which include a plurality of peripheral pixels is defined as search range and the best match diff/offset results are passed in a daisy-chain fashion from one unit to another; col. 7, lines 44-54, the hierarchical search of Butter must be performed this way, otherwise there is no advantage of doing it); and

detecting an optimal motion vector (the motion vector that minimizes the absolute difference, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49) while sequentially changing the pixel-based sizes of the plurality of motion compensating blocks by using each of the motion vector search ranges determined in the determining motion vector search ranges (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49).

However they do not explicitly teach using linear interpolation to increase a size of the motion vectors. In the same field of endeavor, Karczewicz et al teach using linear interpolation to increase a size of a motion vector (Figs. 20, 21 and 22, col. 42, lines 12-51, when a motion vector is changed from a full resolution to a half resolution or quarter resolution, the size of the motion can be increased). It is desirable to enable more accurate modeling of real motion and help reducing the amount of information that must be transmitted from encoder to decoder and be efficient when performing motion compensation (col. 6 lines 35-40, col. 8, lines 14-23 of Karczewicz et al). Therefore it would have been obvious to one of ordinary skill in the art, at

the time of invention, to use the method of Karczewicz et al to linear interpolation to increase a size of motion vector so that more accurate representation of real motion is achieved efficiently.

Claims 10 and 11 are the corresponding apparatus claims of claim 1. Butter et al teach an apparatus (Fig. 1). Thus Butter et al and Karczewicz et al teach claims 10 and 11 as evidently explained in the above-cited passages.

Regarding claim 2, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 1. Butter et al further teach wherein the determining further includes determining the motion vector search ranges depending upon respective differences in pixel-based values from respective size-reduced reference images (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49).

Regarding claim 3, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 2. Butter et al further teach wherein the determining carries out block matching (abstract, col. 6, lines 13-23, col. 7, lines 2-6, col. 8, lines 24-29 and lines 38-49) on the size-reduced reference images with the size-reduced block, so as to determine the motion vector search ranges on the basis of an absolute-value sum of a difference between a pixel-based value within the size-reduced block and a pixel-based value within a block corresponding to the size-reduced block within a predetermined size-reduced reference image (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49). However Butter et al do not explicitly teach the determining step is carried out sequentially. Karczewicz et al teach

sequentially encoding macroblock by macroblock during compression (col. 26, lines 49-54). It is desirable to simplify implementation of the encoder by processing macroblock sequentially. Therefore it would have been obvious to one of ordinary skill in the art, at the time of invention to carry out block matching sequentially to simplify implementation.

Regarding claim 4, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 3. Butter et al further teach wherein the determining further includes determining the motion vector search ranges (col. 6, lines 59-67, Fig. 5) depending upon an absolute-value sum of differences between a pixel value of every other pixel with respect to a horizontal direction and a vertical direction of the size-reduced block and a pixel-based value within a corresponding portion of pixel-based values within the size-reduced block (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49, the absolute difference depends on all the pixel values or the size-reduced block and therefore depends on the absolute-value sum of difference between a pixel value of every other pixel, also every other pixel of a ¼ reduced size block is used for evaluating the absolute difference for the 1/16 reduced size block).

Regarding claim 5, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 3. Butter et al further teach wherein the determining further includes determining as one of the motion vector search ranges a peripheral pixel range including an enlarged lower layer motion vector enlarged from a lower layer motion vector (col. 6, lines 59-67, Fig. 5, the full pixel search after down sampled full pixel search enlarges motion vector)

between a corresponding portion of pixels where an absolute-value sum of pixel-based values within the size-reduced block is minimum and the size-reduced block (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49).

Regarding claim 6, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 1, further comprising:

selecting only the motion vector search ranges within the size-reduced reference images in which a difference of pixel-based values is minimized from the respective size-reduced blocks of among motion vector search ranges within the size-reduced reference images determined in the determining (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49), wherein the detecting further includes detecting an optimal motion vector by using only the motion vector search ranges within the size-reduced reference images selected in the selecting (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49, the motion vector is optimal because it minimizes the difference).

3. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Butter et al in view of Karczewicz et al, further in view of Park et al (US Patent 5,825,930).

Regarding claim 7, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 1. Butter et al further teach wherein: the detecting an optimal motion vector includes detecting the optimal motion vector depending on respective differences in pixel-based values between the size-reduced blocks and the size-reduced reference images

(Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, the search range is reduced each time a change is made, col. 8, lines 38-49). However they do not explicitly teach detecting the optimal motion vector depending on a quantizing scale function and a generation code amount for motion vector differences. In the same field of endeavor, Park et al teach detecting the optimal motion vector depending on a quantizing scale function (col. 2, lines 15-20, Eq. (2), col. 3, lines 56-57, col. 1, lines 36-59, the SAD or MAE is dependent on a quantizing scale) and a generation code amount for motion vector differences (col. 5, lines 6-23, col. 6, lines 7-42, Fig. 4). It is desirable to be efficient in compression (col. 2, lines 44-56 of Park et al). Therefore it would have been obvious to one of ordinary skill in the art, at the time of invention, to use the method of Park et al to detect the optimal motion vector also depending on a quantizing scale function and a generation code amount for the motion vector difference in the method of Butter et al and Karczewicz et al so that the compression is more efficient.

Regarding claim 8, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 1. Butter et al further teach wherein the detecting an optimal motion vector further includes detecting an optimal motion vector based on a minimizing an absolute difference (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34, col. 8, lines 38-49). However they do not explicitly teach the optimal motion vector is detected based on a Rate Distortion optimization process. In the same field of endeavor, Park et al teach detecting the optimal motion vector based on a Rate Distortion optimization process (Eq. (2), Fig. 4, col. 4, lines 7-43). It is desirable to be efficient in compression (col. 2, lines 44-56 of Park et al). Therefore it would have been obvious to one of ordinary skill in the art, at the time

of invention, to use the method of Park et al to detect the optimal motion vector also depending on a quantizing scale function and a generation code amount for the motion vector difference in the method of Butter et al and Karczewicz et al so that the compression is more efficient.

4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Butter et al, in view of Karczewicz et al, further in view of Legall (5,761,398).

Regarding claim 9, Butter et al and Karczewicz et al teach a method of compensating motion prediction according to claim 1. Butter et al further teach wherein the detecting an optimal motion vector includes using different pixel-based sizes of the motion compensating blocks from a greater pixel-based size to a smaller pixel-based size, so as to size-reduce a motion vector search range each time a change is made (Figs. 5-8, col. 6, lines 3-23, col. 6, line 57-col. 7, line 10, col. 7, lines 13-34 and lines 50-54, more than one hierarchical search unit can be used, col. 8, lines 38-49). However they do not explicitly teach sequentially changing the pixel-based sizes of the motion compensating blocks from a greater pixel-based size to a smaller pixel-based size. They do teach using multiple hierarchical search units to increase the search window size (col. 8, lines 30-49). In the same field of endeavor, Legall teaches sequentially changing the pixel-based sizes of the motion compensating blocks from a greater pixel-based size to a smaller pixel-based size so as to size-reduce a motion vector search range each time a change is made (Fig. 4B, col. 10, lines 27-34 and lines 52-67). Using multiple hierarchical stages or levels of hierarchical search to further reduce a motion vector search range by changing from a greater pixel-based size to a smaller pixel based size is efficient in block matching and the result is predictable. It is

desirable to have a robust motion estimation dataflow which maximizes computational power to satisfy real time encoding requirements and minimizes the amount of chip area consumed to implement it (col. 1, lines 47-60 of Butter). Therefore it would have been obvious to one of ordinary skill in the art, at the time of invention, to use the method of Legall to sequentially changing the pixel-based sizes of the motion compensating blocks from a greater pixel-based size to a smaller pixel-based size to size reduce a motion vector search range in the method of Butter and Karczewicz et al so that compression is more efficiently performed in terms of computational power, speed and chip area consumed.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yuzhen Ge whose telephone number is 571-272 7636. The examiner can normally be reached on 7:30am-4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on 571-272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C Bella/
Supervisory Patent Examiner, Art Unit 2624

Yuzhen Ge
Examiner
Art Unit 2624